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ABSTRACT

TELETECHNET, an intercampus instructional television network at Old Dominion University, delivers upper-division coursework for baccalaureate programs to community college sites in the Commonwealth of Virginia. In 1996-97, more than 5,000 students were enrolled in over 20 programs distributed to 40 sites, including community colleges, hospitals, military installations, and corporations. When compared with regular on-campus classroom instructional programs, TELETECHNET achieved essentially equivalent results in learning outcomes, which include student performance, retention, and graduation. Though the quality of instruction is equivalent, TELETECHNET increases student access and provides incentives and opportunities for faculty development and for institutional renewal and growth that are superior to classroom instruction. TELETECHNET is also more cost-effective than sending live instructors to deliver courses at sites throughout the state. When comparing its cost with the cost of on-campus courses, however, TELETECHNET costs are competitive with classroom costs for high-demand, and in some cases, medium-demand courses, but more expensive than classroom instruction for low-demand courses. This is due to its relatively higher fixed costs. (YKH)

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TELETECHNET—Old Dominion University and "Two Plus Two" Programs at Community Colleges in Virginia:

A Case Study in the Benefits and Costs of an Intercampus Instructional Television Network

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TELETECHNET—Old Dominion University and "Two Plus Two" Programs at Community Colleges in Virginia:

A Case Study in the Benefits and Costs of an Intercampus Instructional Television Network

Summary, Findings, and Conclusions

1. In 1992 Old Dominion University began development of an instructional television network, TELETECHNET, to deliver the upper division coursework for baccalaureate programs to community college sites in the Commonwealth of Virginia.

2. In 1996-97 over 5,000 students were enrolled in over 20 programs distributed to 40 sites (23 were community colleges, the remainder were hospitals, military installations, and corporate sites).

Benefit Comparisons

3. Benefits of TELETECHNET were evaluated in terms of comparisons with the regular on-campus classroom instructional program. Benefits are compared in four categories: (1) learning outcomes, (2) student access, (3) institutional renewal/growth, and (4) cost savings.

4. The measure of benefits used here is relative, i.e., "Does TELETECHNET provide an incentive for institutional renewal and growth relative to regular classroom instruction?" The results are presented on the following page in the form of a comparison scorecard that ranks TELETECHNET relative to classroom instruction as follows:

   positive TELETECHNET appears to achieve better results

   neutral the results are equivalent

   negative on-campus classroom instruction appears to achieve better results.

Benefits Scorecard:
TELETECHNET Compared to On-campus Classroom Instruction

Benefit	*Score*
Learning Outcomes	
Learning deemed to be at least equivalent to on-campus classroom instruction as indicated by comparisons of: (a) course grades (regular classroom, TELETECHNET studio, TELETECHNET receive site) (b) student performance on exit writing examination (c) student evaluations of satisfaction with the programs (d) supervisor evaluations (for one program) (e) alumni evaluations (for one program)	neutral
Retention of first-time degree seeking receive site students from fall to spring term is 94 percent, from fall to fall it is 92 percent.	positive
Thirty-seven percent of all degree seeking students first enrolled in 1994 graduated within two years. Fourteen percent of all degree seeking students admitted since the inception of TELETECHNET through spring term 1997 have graduated.	positive
Student Access	
The program in 1996 is estimated to have increased the participation of Virginia residents in four-year public higher education by over 4,000 individuals (a 3.3 percent increase in the participation rate).	positive
Institutional Renewal/Growth	
Faculty who have taught on TELETECHNET were generally supportive and indicated the experience has led to positive changes in their teaching methods. (Faculty also indicated concerns about the workload and logistics.)	positive
Old Dominion is developing specific articulation agreements with 23 community college campuses for the 20 degree programs currently offered via TELETECHNET.	positive
Cost Savings	
There is substantial savings over sending live instructors to several off-campus sites. For a comparison with on-campus classroom instruction costs see the section on costs.	positive

5. In brief, learning outcomes were deemed essentially equivalent (not significantly different) for the alternative modes of instruction. TELETECHNET improves student access and provides incentives for faculty development and institutional growth in terms of expanding and coordinating the university's instructional programs with other institutions, especially the community colleges.

Cost Comparisons

6. In order to make comparisons of TELETECHNET costs, alternative delivery approaches must be assumed. One alternative is to compare the costs of sending live instructors to offer courses at several remote sites. This is an alternative that has never been suggested or proposed by anyone probably because it is very expensive and cumbersome. This study confirms what should be intuitively obvious—that TELETECHNET represents a substantial cost savings over sending live instructors to deliver courses at sites throughout the state.

7. An alternative to sending instructors to remote sites is to compare TELETECHNET course costs to the costs of on-campus courses. The problem with this comparison is whether it is fair to assume the receive site students could, in fact, afford to move to attend on-campus courses. The comparisons are made, nonetheless. To the extent TELETECHNET estimated costs are even reasonably close to classroom instruction costs, TELETECHNET might be considered a bargain to the state in the sense that moving and relocation costs (no matter who incurs them) for students who are to attend the on-campus courses also should be charged against classroom instruction.

   (a) Comparisons of estimated course costs suggest that for high demand courses (over 200 students statewide), TELETECHNET compares favorably with on-campus delivery where on-campus course section size is 25 or less. As TELETECHNET expands and achieves greater economies of scale, its costs for these high demand courses will compare favorably with on-campus courses taught with section size of 50.

   (b) For "medium" demand courses, 100 students statewide, classroom delivery is less expensive at current levels of operation. As TELETECHNET expands, its costs will become more competitive with classroom instruction at least where the classroom section size is 25 or less.

   (c) For "low" demand courses, 50 students statewide, even when operating closer to capacity, TELETECHNET costs will exceed classroom costs.

Conclusions

8. The quality of instruction provided via TELETECHNET is equivalent to that provided by on-campus classroom instruction. TELETECHNET increases student access and provides incentives and opportunities for faculty development and for institutional renewal and growth that are superior to classroom instruction.

9. For high demand courses (200 students) and, in some cases, for medium demand courses (100 students), TELETECHNET costs are competitive with classroom costs. Because of its relatively higher fixed costs, TELETECHNET delivery is more expensive than classroom instruction for low demand courses (50 students or less).

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Background and Context

Old Dominion University, a public institution in the Commonwealth of Virginia, is located in the city of Norfolk. It is part of the large urban, commercial, industrial, maritime, and military complex known as Hampton Roads at the entrance to Chesapeake Bay. Old Dominion offers a range of undergraduate and graduate programs with an emphasis in engineering and science and other professional disciplines to approximately 14,000 students.

The university's involvement in distance education and instructional television goes back to the mid-1980s when it was used for the remote delivery of engineering courses. In 1992 a proposal was developed at Old Dominion for "TELETECHNET," a network that would expand delivery of "two plus two" degree completion programs to the 23 community colleges in the state. The name two plus two denotes the fact that the first two years of study (freshman and sophomore) toward a baccalaureate degree are provided by the community college, the second two years (junior and senior) by the university.[1]

The three major objectives of the proposal[2] were:

- To provide higher education access to students who are unable to move to the campus of one of Virginia's universities.

  The unique aspect of TELETECHNET is that the second two years of university instruction are provided to the community college sites via TELETECHNET. Thus, students attending a community college could complete their lower division studies and move directly to upper division coursework without relocating to a university campus. Such an arrangement is substantially more than a convenience to the students. This is especially so when the individual is placebound, i.e., older, working, and with family responsibilities. Such individuals are more mature and motivated sufficiently to benefit from a university degree but may not be able to afford to relocate to where the instruction is available.

- To provide a cost-effective means to serve a large number of additional students who will seek to enter the commonwealth's colleges and universities in the early part of the next century.

  Providing such access to potential students becomes even more important if the state's population is growing, the share of occupations requiring a college degree is increasing, and the state cannot afford to start new universities.

  Aside from having students move to the sites of the existing universities, the alternatives for providing access to university degree programs are to send instructors to remote sites to teach small classes, to build new university campuses, or to add facilities at community college sites to accommodate TELETECHNET enrollments.

- To stimulate economic development in areas of the commonwealth where there is a demonstrated shortage of highly trained employees in critical occupations such as engineering and nursing.

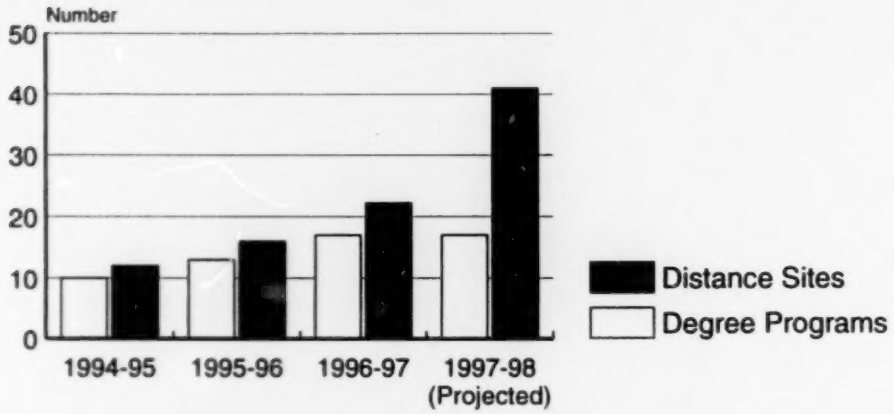
[1] A basic component for a two plus two program is that the university and community college curriculum for the major be fully compatible. The lower division general education and major courses offered at the community college are accepted in full to complete the degree and major program requirements of the university.

[2] The bullets are from Old Dominion University, TELETECHNET Progress Report, 1994-1997.

With approximately three million dollars of funding, the network began operation in 1994 offering ten degree completion programs at twelve community college sites via an analog Ku-band satellite system providing one-way video and two-way audio. (In the summer of 1995, the system was changed to a proprietary, Ku-band, digital network with an uplink on the Old Dominion University campus and downlinks at each site; operated by COMSAT, with a contract which extends to 1998.) The system provides voice and data connectivity through a "ring-down" service through MCI providing quarter to full T-1 interactive capability.

The growth in TELETECHNET degree programs and distance sites is shown in Figure 1.

Figure 1—Growth in TELETECHNET Degree Programs and Sites

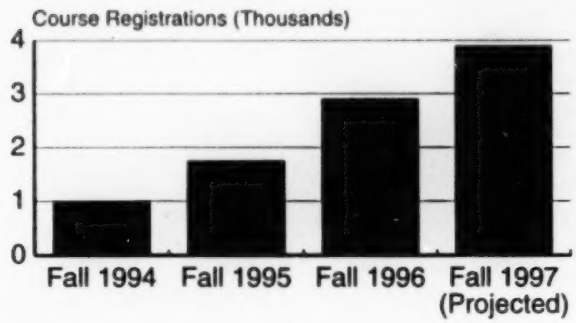


Due to a demonstrated need, in the spring of 1995 the General Assembly provided additional funding of $800,000 to add more community college sites to the network and in 1996, as a result of the success of the program, the General Assembly allocated $900,000 in funding for each year of the biennium to establish sites at the remaining community colleges. All 23 community colleges will be participating in the network by the fall of 1997. In addition to community colleges, downlinks have been established at other sites including corporations, such as Ford and Ingersoll-Rand, and military bases, such as Langley Air Force Base and Quantico Marine Base.[3] Each non-community college site is coordinated with the local community college which typically offers lower division classes at that same site.

[3] The number of programs and sites is a moving target. As of June 1997, a total of 40 sites was projected for fall term 1997. When fall term opens, the total will be closer to 45 sites.

Figure 2 shows the growth in enrollment from fall of 1994 through the projected enrollment for fall of 1997 at the community college sites. Other data show that TELETECHNET students are older than on-campus students (mean age is 34 years), more likely to be (or have been) married (more than half), more likely to have children (more than half; 10 percent have dependents other than children at home), and more likely to work more than 30 hours per week (three-fourths). Additionally, most (85 percent) enter the program directly from the local community college and live within 30 miles of the community college site. As can be seen from Figure 2, TELETECHNET is clearly succeeding in its objective to provide access to higher education for students who are unable to relocate because of employment, marital status, distance, or expense.

Figure 2—Growth in Enrollment



Benefits of TELETECHNET

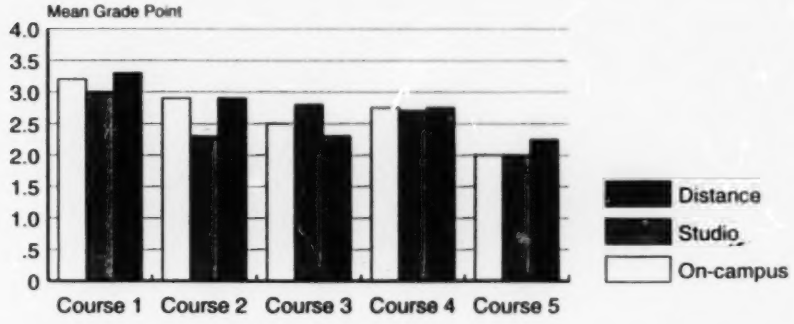
Student Learning Outcomes

Performance in Courses

To help assess the quality of the academic experience offered to distance students, course grades from five undergraduate courses in the fall semester of 1996 were analyzed to determine if the performance of students differed by the modality of instruction. Each of these courses was taught (a) in a regular classroom format *on campus*, (b) in a TELETECHNET format to students in the television *studio* on campus, and (c) in a TELETECHNET format to *distance* students at multiple distance sites via a one-way video and two-way audio connection. Each of these courses was taught by the same instructor in each of the formats.[4]

Figure 3 shows the (unadjusted) mean grade points for the five courses offered in the three modalities.

Figure 3—Grades in Five Courses, Fall 1996



A hierarchical multiple regression analysis was conducted on these data (with the modality variable entered last) to adjust for possible differences between on-campus, studio, and distance students in age, gender (*male* = 1, *female* = 2), ethnicity (using the categories of *white* = 1, *other* = 2), and ability (*cumulative GPA based upon grades at Old Dominion only*). Because the courses differed in level of difficulty, with the least difficult course having few distance students and the most difficult course having many distance students, course difficulty was also entered into the equation by ranking the courses on mean grade point in the traditional on-campus sections. Table 1 shows the results of this analysis.

[4] The courses were in counseling, education, information systems, and sociology. A total of 273 students were enrolled in the classroom version of the course; 71 were in the TELETECHNET studio classrooms, and 296 were at the TELETECHNET receive sites.

Table 1—Multiple Regression Analysis for Course Grades in Three Modalities, Fall 1996

Varibles	Beta	Significance level
STEP 1:		
Ability	.67	.001
Course Difficulty	-.39	.001
Ethnicity	-.06	ns
Gender	-.04	ns
Age	.04	ns
STEP 2:		
Modality of Instruction	.01	ns

(ns = not significant)

After adjusting for differences in ability, course difficulty, ethnicity, gender, and age, there is no significant difference in course grades earned by students on campus in a regular classroom, on campus in the TELETECHNET broadcast studio, or at the TELETECHNET receive sites for these five courses.

An analysis of twenty additional undergraduate TELETECHNET courses for fall 1996, comparing grades of on-campus studio students with receive site students, shows the same pattern of results (see Table 2). After adjusting for ability, ethnicity, gender, and age, there was no significant difference in the course grades earned by students in the TELETECHNET studio on campus and students at the TELETECHNET receive sites. (Course difficulty was not entered into the equation because the number of courses was sufficient to balance the effect of this variable over the modalities.)

Table 2—Multiple Regression Analysis for Course Grades in Two Modalities, Fall 1996

Variables	Beta	Significance Level
STEP 1:		
Ability	.77	.001
Ethnicity	-.01	ns
Gender	-.05	.01
Age	-.01	ns
STEP 2:		
Modality of Instruction	-.01	ns

(ns = not significant)

For spring semester 1997, four instructors taught an undergraduate course in the three modalities (classroom, and TELETECHNET including live studio class and receive site students).[5] Figure 4 shows the (unadjusted) mean grade points for these courses. A hierarchical multiple regression analysis was also conducted on these data, once again entering the modality variable last. Table 3 shows the regression results.

Figure 4—Course Grades, Spring 1997

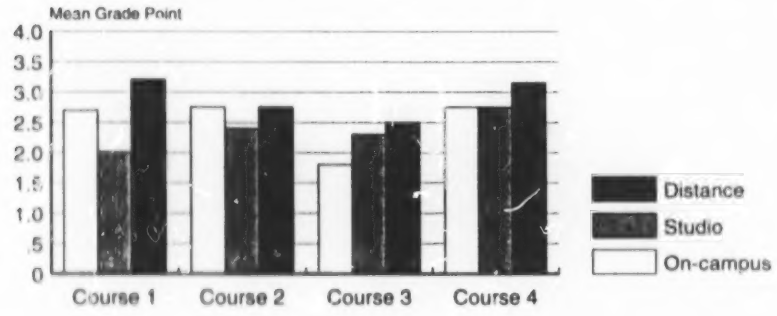


Table 3—Multiple Regression Analysis for Course Grades in Three Modalities, Spring 1997

Variables	Beta	Significance Level
STEP 1:		
Ability	.76	.0001
Ethnicity	.05	ns
Gender	.06	ns
Age	.01	ns
STEP 2:		
Modality of Instruction	.05	ns

(ns = not significant)

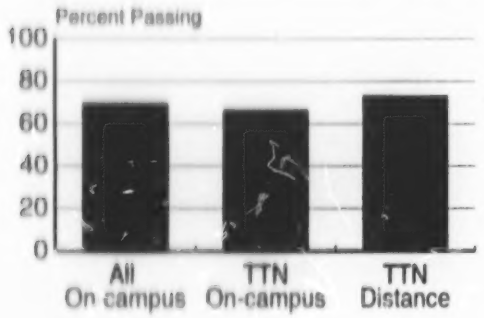
It appears from Figure 4 that distance students have a grade advantage. Once again, however, using regression to adjust for differences in ability, ethnicity, gender, and age (course difficulty was not entered into the equation) shows there is no significant difference in course grades earned by students on campus, in the TELETECHNET studio, or at the TELETECHNET distance sites for these four courses, each of which was taught in all three modalities by the same instructor in spring 1997.

[5] The courses were in accounting, economics, and marketing. On-campus classroom enrollments totaled 93, TELETECHNET studio enrollments were 28, receive site enrollments were 106.

Performance on Exit Writing Exam

All graduating seniors at Old Dominion University are required to pass the Exit Exam of Writing Proficiency. Figure 5 shows the pass rates for (a) all on-campus students (n = 4,471) who took the exam between June 1, 1995, and February 10, 1997, (b) on-campus students majoring in one of the TELETECHNET programs (n = 980) who took the exam in this time frame, and (c) TELETECHNET distance students who took the exam in this period (n =310).

Figure 5—Pass Rates on Student Writing Examination



While there was no significant difference (*CHI SQ* = 1.64) between the pass rates for all on-campus students (69 percent) and TELETECHNET distance students (73 percent), there was a significant difference (*CHI SQ* = 4.35, $p < .05$) between the pass rates for on-campus students majoring in a TELETECHNET program (66 percent) and TELETECHNET distance students (73 percent). However, when these data are adjusted for ability, gender, age, and ethnicity, using a logistic regression analysis, this difference disappears (*Wald* = 2.03, p = ns). It should also be noted that students who enter the TELETECHNET program at distance sites are more likely to pass the Writing Sample Placement Test (82 percent), a placement test given to all students who are admitted to the university, than students who transfer to the main campus in Norfolk (64 percent).

Student Surveys

Student surveys provide another perspective on the learning experience. In particular, did the students involved with the TELETECHNET courses evaluate their learning experiences differently than regular on-campus courses?

Course Evaluations

Student evaluation data from four undergraduate courses taught in three modalities (on-campus, studio, and distance) in the fall semester of 1996 are shown in Figure 6. A 3 x 7 mixed factorial analysis of variance (3 modalities x 7 items from the student evaluation form) was conducted on these data; there were no significant differences in student course evaluations in the three modalities of instruction (main effect: F = .06, df = 2 & 9, p = ns; interaction: F = .38, df = 12 & 54, p = ns). Student evaluation data from 13 undergraduate courses offered in two modalities (studio and distance) in the fall of 1996 likewise showed no significant differences in student evaluations of instruction across modality (main effect: F = 1.6, df = 1 & 24, p = ns; interaction: F = 1.76, df = 6 & 144, p = ns).

Figure 6—Student Evaluations from Four Courses, Fall 1996

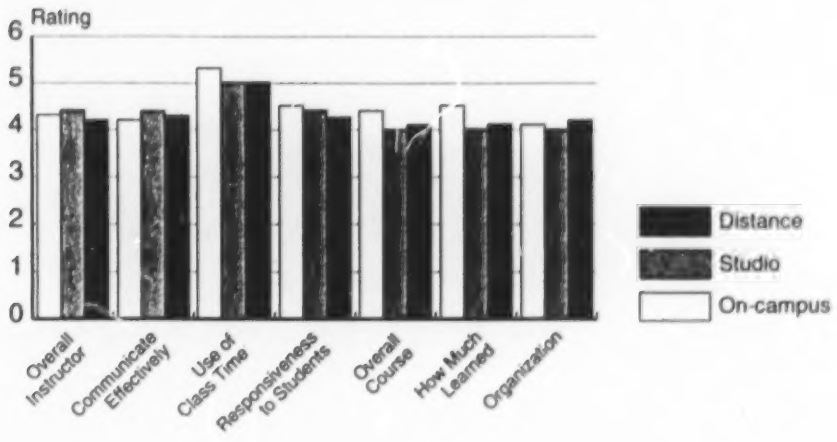
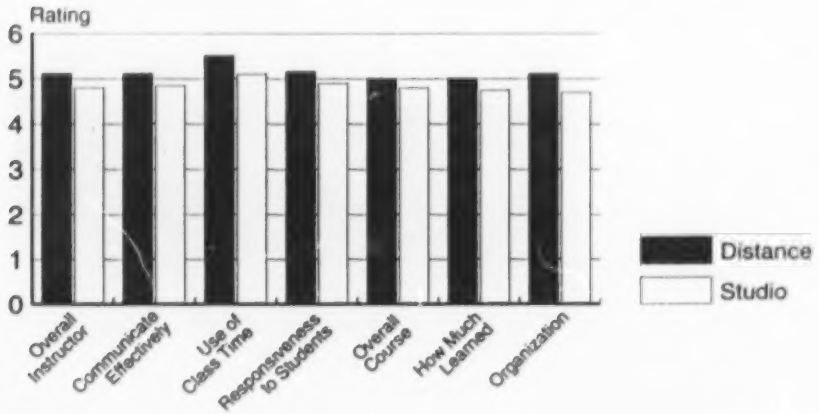


Figure 7 presents student evaluation data from 17 courses offered in two modalities, studio and distance, in the spring of 1997. (Data were available from only two of the courses offered in three modalities and are, therefore, not shown.) A 2 x 7 mixed factorial analysis of variance (2 modalities x 7 items from the student evaluation of instruction form) was conducted on these data and found no significant differences in student evaluations of instruction across modality (main effect: $F = 2.41$, $df = 1$ & 32, p = ns; interaction: $F = .43$, $df = 6$ & 192, p = ns).

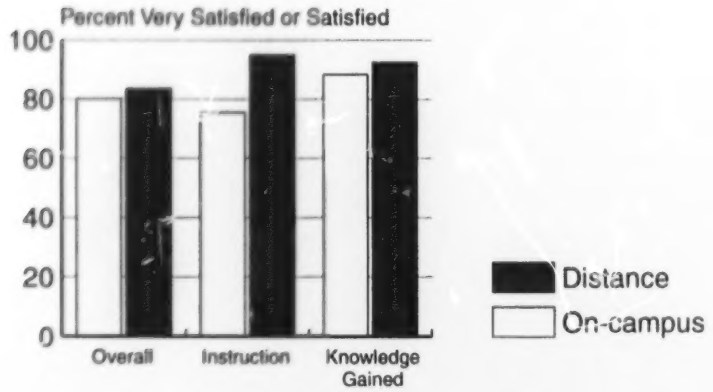
Figure 7—Student Evaluations from Seventeen Courses, Spring 1997



Student Satisfaction, Graduating Seniors

All graduating seniors at Old Dominion University, both on-campus and distance students, are required to complete a Student Satisfaction Survey. Figure 8 shows the percent of on-campus students (who were majoring in one of the TELETECHNET programs) and distance students who indicated they were Very Satisfied or Satisfied with their experience overall, with the instruction they received, and with their knowledge of subject matter in their major program. These data were collected between May 1, 1996, and April 30, 1997; in this time interval 442 on-campus students in a TELETECHNET major and 76 distance students responded.

Figure 8—Student Satisfaction, 1996-97



A hierarchical multiple regression analysis was conducted on these data (with the modality variable entered last) to adjust for possible differences between on-campus and distance students in age, gender, ethnicity (using the categories of *white* and *other*), and ability (*cumulative GPA*). Table 4 shows the results of these analyses. After adjusting for age, gender, ethnicity, and ability differences between on-campus and distance students, distance students were significantly more satisfied overall and more satisfied with instruction. There was no significant difference between groups in their satisfaction with knowledge gained.

Also, on several other items that might be expected to show lower satisfaction levels at distance sites (because of more limited contact with faculty), there were no differences between on-campus students and distance students. Satisfaction with advising and with feedback on written work was equal for the two groups (within two percentage points) and satisfaction with opportunities for interaction with faculty members showed a four point advantage for distance students over on-campus students.

Table 4—Multiple Regression Analyses for Satisfaction, 1996-1997

Variables	Beta	Significance Level
OVERALL SATISFACTION		
STEP 1:		
Ability	.01	ns
Ethnicity	.03	ns
Gender	.04	ns
Age	.01	ns
STEP 2:		
Modality of Instruction	.12	.04
SATISFACTION WITH INSTRUCTION		
STEP 1:		
Ability	-.05	ns
Ethnicity	-.01	ns
Gender	.05	ns
Age	.03	ns
STEP 2:		
Modality of Instruction	.16	.008
SATISFACTION WITH KNOWLEDGE GAINED		
STEP 1:		
Ability	.07	ns
Ethnicity	.02	ns
Gender	-.02	ns
Age	.13	ns
STEP 2:		
Modality of Instruction	.03	ns

(ns = not significant)

Retention and Graduation Rates

Retention in the programs offered through TELETECHNET has been very high. Ninety-four percent of the degree seeking students who enrolled in fall 1994, the first semester of TELETECHNET, re-enrolled in the spring of 1995; ninety-two percent of those students re-enrolled in courses the following fall semester. Additionally, TELETECHNET students are as likely to finish a degree program within two calendar years as on-campus transfer students, in spite of the fact that they work more hours during the week—37 percent of TELETECHNET degree seeking students complete their degree in two years. No doubt this success is attributable to the enhanced maturity and greater career focus of the TELETECHNET students.[6]

[6] The Office of Institutional Research and Planning at Old Dominion is currently engaged in a major study of the retention and graduation patterns of TELETECHNET students. The results from this study will be available in the fall of 1997.

In-depth Studies of Specific Degree Programs

To provide information on the performance and satisfaction of students at the level of specific programs, four of the more mature TELETECHNET programs were selected as case studies. Two of these programs, Nursing and Engineering Technology, were the first two programs offered at distance sites, providing the groundwork for TELETECHNET. While most of these data are not student-identifiable, and hence do not allow for statistical adjustments for demographic differences, the satisfaction data and the performance data from capstone courses within these programs provide a valuable perspective on the TELETECHNET experience.

Human Services Counseling

The Human Services Counseling program is, because of its emphasis on interpersonal skills, one that might not be expected to thrive when offered in the distance format. The data, however, show otherwise. Figure 9 shows the satisfaction of on-campus seniors ($n = 42$) and distance seniors ($n = 45$) with the extent to which they achieved the major goals of the program. There are no significant differences in the satisfaction of on-campus students and distance students in regard to these four program goals (*CHI SQ*'s < 8.37, *p*'s = ns).

Figure 9—Satisfaction with Knowledge and Skills of Seniors in Human Services Counseling

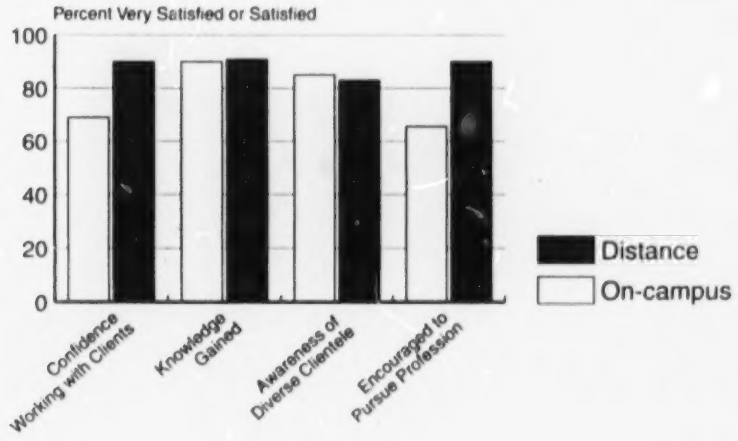
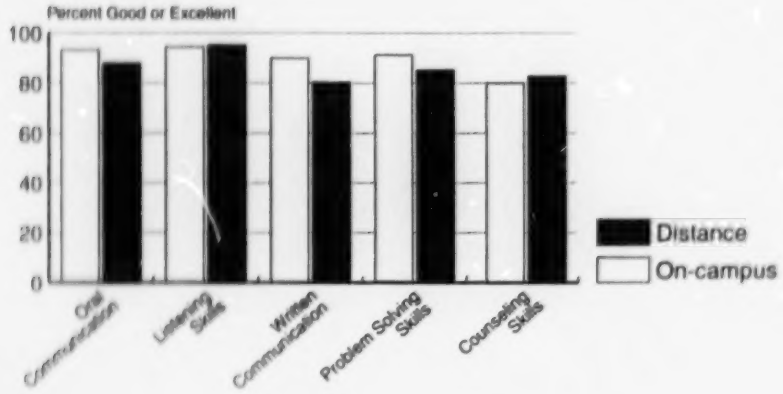


Figure 10 shows supervisor ratings of on-campus students (n = 36) and distance students (n = 26) in the capstone internship experience. In regard to oral and written communication skills, listening skills, problem-solving, and specific counseling skills, the ratings of supervisors showed no significant differences (*CHI SQ*'s < 3.35, p's = ns) in the performance of these students. These ratings of internship supervisors, independent professionals working in the field, serve as important external evaluations of the quality of students graduating from Old Dominion University.

Figure 10—Supervisor Ratings of Interns in Human Services Counseling

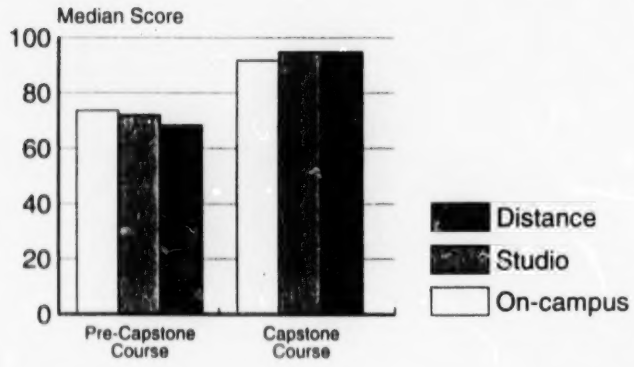


Criminal Justice

The Criminal Justice program has been offered via TELETECHNET since 1994 and is currently one of the largest in terms of enrollment. Figure 11 shows the performance of on-campus students and distance students in the pre-capstone course (Research Methods) and the capstone course (Data Analysis). Both courses require a research project and both courses were recently offered (a) in a traditional format on campus, (b) in a TELETECHNET format to on-campus students in the television studio, and (c) in a TELETECHNET format to students at multiple distance sites. Because the distributions were skewed, the median scores are shown in the chart. While distance students scored significantly lower than on-campus students in the pre-capstone course (*CHI SQ* = 22.45, p < .01), they scored significantly higher than on-campus students in the capstone course (*CHI SQ* = 14.06, p < .001).

The instructor of these courses reports that (a) he perceives no meaningful difference in the quality of written work received from TELETECHNET students and on-campus students, (b) communication with distance students is as good as or better than communication with on-campus students, via e-mail and voice-mail, (c) students at distance sites are as likely to ask questions and engage in discussion as students on campus, and (d) because distance students are scattered at multiple sites, often with two to ten students per site, they tend to perceive classes as small and intimate, with a sense of cohesion and support.

Figure 11—Capstone Performance, Criminal Justice Students



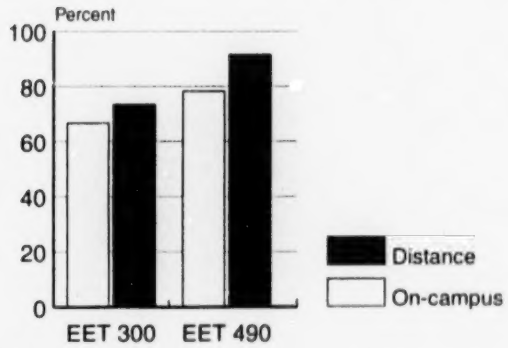
The instructor also reports that some of the animation and graphical materials (developed in the technological atmosphere of TELETECHNET courses) that are used for instruction in statistical procedures in TELETECHNET are now used in traditional classes on campus, via videotape. Furthermore, because TELETECHNET students were required to submit their oral reports of capstone projects on videotape, and hence, because of the feedback offered by this modality, were judged superior in this regard than the first-run presentations of on-campus students, on-campus students are now required to submit their oral reports of capstone projects on videotape as well.

Engineering Technology

In 1988, the faculty in the Department of Engineering Technology began offering engineering technology programs at a community college in western Virginia. In the 1997-98 academic year, it will offer engineering technology programs at all community colleges in the commonwealth.

Figure 12 shows the performance of on-campus students and distance students on the final exam in the pre-capstone course and on the major project in the capstone course. The differences between the on-campus and distance students shown in this chart are not significant (t's < 1.80, p's = ns).

Figure 12—Capstone Performance, Engineering Technology Students



The department chair reports that distance students typically perform as well as or better than students on campus. He attributes this to the greater maturity and career focus of distance students. Furthermore, he reports that providing enhanced access to higher education programs for placebound students at distance sites is a rewarding and challenging experience.

Nursing

In 1987, the School of Nursing initiated a televised baccalaureate program for registered nurses living on the remote Eastern Shore of Virginia. In 1988, the program was expanded to cover Suffolk, Portsmouth, and Virginia Beach. In 1994, TELETECHNET was implemented, and the Bachelor of Science in Nursing and the Master of Science in Nursing programs are now beamed throughout the Commonwealth of Virginia.

The School of Nursing has been assessing its programs throughout this development, to ensure the quality of its offerings. Figure 13 shows student performance on major projects in the two pre-capstone courses. There is no difference in the performance of students on campus, in the television studio, and students at the distance sites (F's < 1, p's = ns).

As part of the assessment program for the School of Nursing, alumni surveys are sent to recent graduates. While the return rate for the baccalaureate alumni is too low to be of value (10 percent), the return rate for the alumni survey for the graduates of the Master of Science in Nursing program (MSN) is sufficient to be of value (34 percent).

Figure 13—Performance of Nursing Students in Pre-Capstone Courses

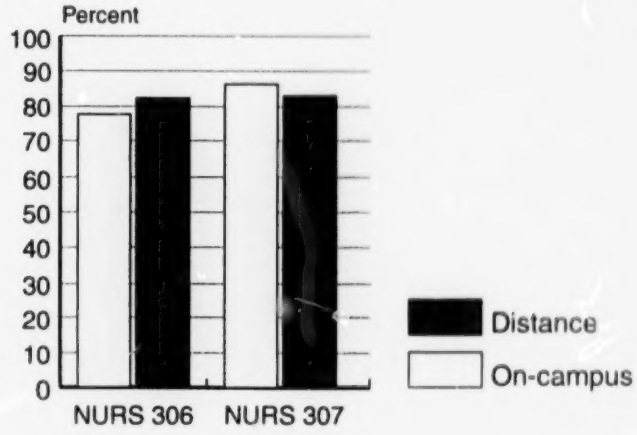


Figure 14 shows the satisfaction ratings of on-campus alumni (n = 12) and TELETECHNET alumni (n = 20) for the extent to which they achieved the major program objectives. There are no differences between the alumni of the two programs (*CHI SQ*'s < *5.5*, *p*'s = *ns*).

Figure 14–Satisfaction with Attainment of Program Objectives, MSN Alumni

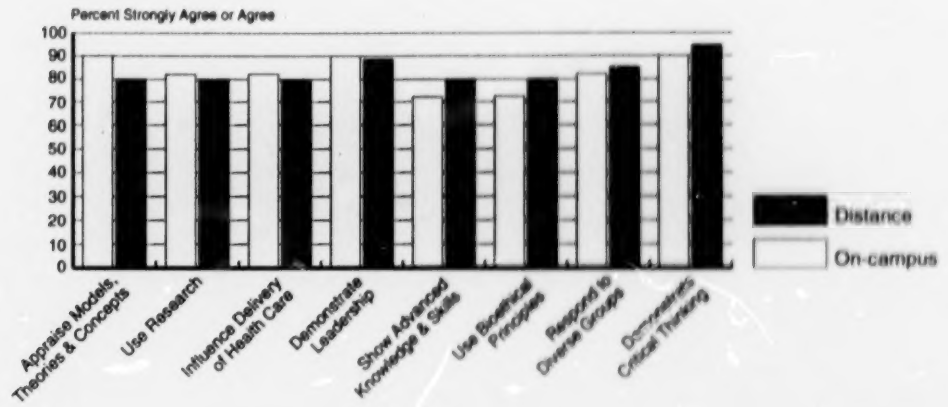
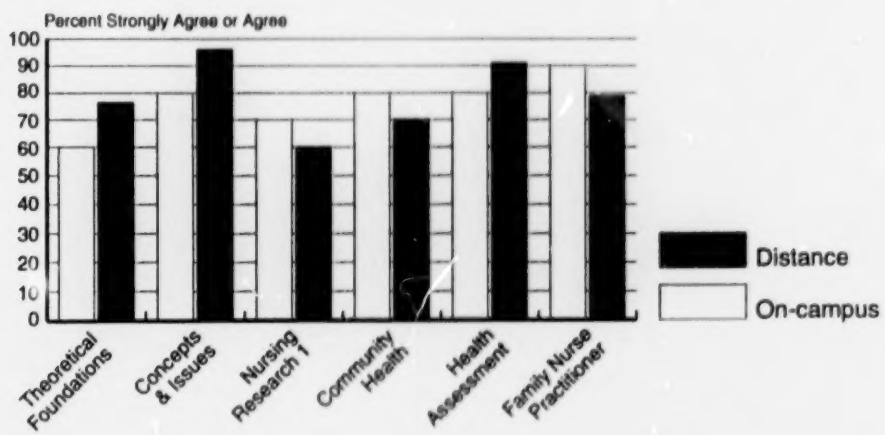


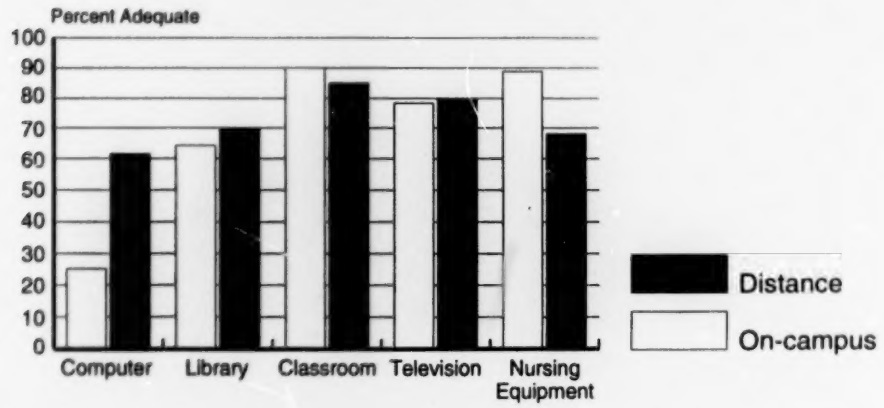
Figure 15 shows the evaluation of the core courses by alumni within the Master of Science in Nursing program. Alumni were asked whether these courses provided adequate opportunities for learning. As can be seen from the chart, alumni of the on-campus program and the distance program did not differ in their evaluations of these core courses (*CHI SQ*'s < *7.27*, *p*'s = ns). Hence, these on-campus alumni and TELETECHNET alumni rate the degree to which they achieved the objectives of the program and the quality of the core courses as equal.

Figure 15–Satisfaction with Course Content, MSN Alumni



Finally, Figure 16 shows satisfaction of these alumni with the facilities at the on-campus and distance sites. Distance alumni were both more and less satisfied with computer facilities, depending on the specific site ($CHI\ SQ = 10.82$, $p < .05$). There were no other significant differences in satisfaction with facilities at the on-campus site and the distance sites.

Figure 16—Satisfaction with Facilities, MSN Alumni



Student Learning Outcomes Summary

The results of this research clearly indicate that, by every measurable criterion, the quality of education offered via TELETECHNET—to predominantly placebound, nontraditional students—is equal to that of the programs offered on the Norfolk campus of Old Dominion University.

Now that the basic question of the quality of the distance programs at Old Dominion has been answered, the focus of the research efforts will change to that of determining how the high-technology platform of TELETECHNET can be optimized to enhance teaching and learning—to produce learning and performance not just equal to that of traditional modes of instruction on campus, but to produce superior results. This issue of enhanced quality is intrinsically linked to the issue of enhanced productivity. Clearly, TELETECHNET has made great strides here, but the Faculty Survey indicates that, despite high levels of support for the program, the issue of workload remains a significant problem. The leading source of frustration for faculty in this regard is the awkward and time-consuming distribution of materials to and from the distance sites. Efforts to resolve this problem, via electronic distribution channels, will continue in the coming year. Consolidation and integration of operations must occur lest the rapid growth of TELETECHNET overwhelms the administration, faculty, and staff that compose the human elements of the system.

Student Access

The demographics of the TELETECHNET students are substantially different than the demographics of the on-campus students--TELETECHNET students are older (average age is 34), more likely to be (or have been) married, more likely to have children or other dependents at home (57 percent are women), and more likely to work more than 30 hours a week (88 percent). Additionally, most (85 percent) enter the program directly from the local community college and live within 30 miles of the community college site.

Table 5--Estimated Impact of TELETECHNET upon Access to Public Higher Education in Virginia

(1)	Virginia population age 18-64 in 1996 (*based upon Census Bureau estimate*)	4,316,000
(2)	In-state enrollment at Virginia public four-year campuses 1996 (*source: SCHEV*)	133,205
(3)	Participation rate (=row 2/row 1)	3.09%
(4)	**TELETECHNET** enrollment (1996-97)	5,012
(5)	**TELETECHNET** students who would not have attended the Old Dominion campus (*see discussion in text*)	4,313
(6)	Participation rate net of **TELETECHNET** students who would not have attended otherwise = (row 2-row 5)/row 1	2.99%
(7)	Estimated effect of **TELETECHNET** on statewide participation rate =100*(1-(row 3/row 6))	+3.3%

How many of these students would not have participated in a baccalaureate program had the programs not been available via TELETECHNET at a local community college site? An answer to this question provides an estimate of the impact of TELETECHNET on participation in public higher education in Virginia. Table 5 provides the relevant data on population, enrollment, and participation rates.

In 1996-97 TELETECHNET receive sites enrolled a total of 5,012 individual students. Of this total approximately 110 were enrolled at sites located within 30 miles of Old Dominion. Had TELETECHNET not been available it is reasonable to assume that most, if not all, of these individuals could have commuted to the campus to take courses. Of the remaining 4,902, it is assumed that the 88 percent (4,313) working 30 or more hours per week could not have afforded to move to the vicinity of the campus to take courses (see row 5 in the table). Simply stated, it is estimated that in 1996 TELETECHNET provided access for over 4,000 individuals who otherwise would not have participated in public higher education. As illustrated in Table 5, another way to say this is that TELETECHNET increased 1996 public higher education participation rates in Virginia by about 3.3 percent.

Institutional Renewal and Growth

This category of benefits relates to whether a particular application of mediated instruction has motivated or facilitated institutional change. The changes in this case relate especially: (1) to faculty development and the opportunities of individuals to obtain training and the opportunities to teach courses on TELETECHNET and (2) to institutional growth as Old Dominion has developed a set of articulation agreements with all of Virginia's community colleges to provide the lower division instruction for the university's degree programs.

Faculty Development

Old Dominion has sponsored a series of summer workshops to prepare faculty for teaching in the studio classroom environment. Attendance at the workshops is voluntary. Under certain circumstances, however, faculty receive a stipend for attendance. Since the inception of TELETECHNET over 200 faculty have participated in the workshops.

To gain an understanding of faculty perceptions of TELETECHNET after they have taught on it, a survey was developed and mailed to 78 full-time faculty who had taught on TELETECHNET in the fall semester of 1996 or the spring semester of 1997. Two mailings of the survey were sent between mid-April and mid-May of 1997. Forty-seven faculty returned surveys for a return rate of 60 percent. Forty percent of these faculty had taught on TELETECHNET only once, 15 percent twice, and 45 percent three or more times.

A majority of the faculty said they found teaching on TELETECHNET a rewarding experience, would teach on TELETECHNET again, cover the same content in the same depth as on campus, and think they are a better teacher now because of the experience (see Table 6). About a quarter said they had trouble adjusting to the technical aspects of TELETECHNET and just less than a quarter thought the workload policy is fair and reasonable. These last two items were significantly correlated ("adjusting to technical aspects" negatively correlated) with the respondents' willingness to teach on TELETECHNET again, and the workload item was significantly correlated with the respondents' perception that it was a rewarding experience and that they could cover the same content in the same depth.

Table 6—TELETECHNET: A Rewarding Experience?

Item	Percent Agree
Found it a rewarding experience	70%
Would teach on TTN again	61%
Cover the same material in the same depth as on campus	59%
A better teacher now because of TTN	55%
Had difficulty adjusting to the technical aspects of TTN	26%
Workload policy is fair and reasonable	22%

When asked specifically what they found rewarding about the experience, they said (a) providing educational access for more students, (b) teaching a more diverse group of students (nontraditional), and (c) developing new instructional techniques and participating in the development of a cutting-edge, educational technology.

About half said that the experience was a source of reinvigoration for them and that they had developed skills as a result of the experience (see Table 7). Half thought the orientation program prepared them for the experience; high ratings of the orientation program were correlated with perceptions of reinvigoration and skill development.

When asked specifically about what they found reinvigorating about the experience, they said (a) it enhanced their technological and computer skills, and (b) it enhanced their organizational and teaching skills.

Table 7—TELETECHNET: A Reinvigorating Experience?

Item	Percent Agree
A source of reinvigoration	46%
Developed skills as a result of TTN	51%
Re-conceptualized my course	39%
Changed instructional methods	69%
Orientation program prepared me	49%

The leading sources of frustration for these faculty are, in rank order, (a) the mechanics of distribution of materials to and from sites, (b) technical and production problems, (c) the increased workload, (d) limitations on instructional effectiveness (limitations on writing, critical thinking, discussion, group projects), (e) one-way video, and (f) on-site problems. When asked how they would improve TELETECHNET, two-way video topped the list: 80 percent said it was important to add two-way video.

When asked about their perceptions of distance students, 19 percent of the faculty said they were somewhat better than on-campus students, 54 percent said they were about the same, and 28 percent said they were somewhat worse than on-campus students.

Finally, about 85 percent of the faculty who responded to the survey said that TELETECHNET is a benefit to the university and the people of Virginia. This last finding is important in terms of the student learning outcomes benefit discussed earlier in this report. The clear implication, in spite of the concerns noted above, is that the faculty believe the TELETECHNET program is providing good learning experiences for students.

Institutional Growth

The premise of a two plus two program is that a community college provides all the lower division coursework necessary for a given baccalaureate program and that the degree granting university provides all the upper division work. For each of the 20 degree programs offered in TELETECHNET, Old Dominion has developed a summary planning sheet that indicates all of the general education and lower division course requirements that must be satisfied by community college coursework and all of the upper division requirements for the given degree that are provided via TELETECHNET. The sheet also includes summary information on admissions to Old Dominion, financial aid, and graduation requirements. This planning sheet can be provided to anyone expressing interest in the degree.

In addition, each community college campus where the upper division coursework will be received has a similar planning sheet that specifies that campus's lower division courses that satisfy the general education and lower division major course requirements. Thus, a prospective student at any of the community college campuses can conveniently obtain information on one or several degree programs offered via TELETECHNET and identify the specific courses at the community college that will satisfy those requirements.

These planning sheets are fully developed articulation agreements between Old Dominion and each of the community colleges. Approximately 20 degree programs and 23 community college campuses suggests the need for 460 such agreements if all campuses were offering lower division work for all degrees. This is, of course, a major undertaking that, when completed, will have Old Dominion's degree programs essentially integrated with the programs at the community colleges. TELETECHNET has provided both the framework and the incentive to accomplish this result, which is an obvious plus for the community college students of Virginia.

TELETECHNET Costs

TELETECHNET courses originate from Old Dominion University and are taught primarily by Old Dominion full-time faculty (in fall 1996 approximately 92 percent of courses). The number of receive sites is expanding past 40. The number of major programs is expanding, as are the numbers of courses, total enrollments, and FTE.

Cost Projections for TELETECHNET

A detailed cost projection for TELETECHNET was available in the 1993 proposal document.[7] The projection is based upon the capacity to offer 500 courses per year in 20 degree programs to approximately 12,000 students (4,500 FTE) located across 25 sites. Examination of these cost projections is a useful exercise in itself and also serves as a basis for comparison with the reported costs of the program as it is currently operating.

The costs are shown in Tables 8 through 10. Table 11 summarizes the data and provides an estimate of per course costs based upon TELETECHNET operating at capacity.

Table 8—Estimated Capital Cost to Fully Develop the TELETECHNET Program

Equipment Item	Cost	Useful life*	Annual cost
Uplink	$75,000	15	$5,000
Codecs	1,000,000	10	100,000
Receive dishes	450,000	15	30,000
Transmit classrm. equip.	1,714,000	10	171,400
Computer labs @ CC	1,080,000	5	216,000
Computer support ODU	720,000	5	144,000
Library technology	470,000	10	47,000
Furniture	575,000	15	38,333
Transmission facility	6,200,000	25	248,000
Total	$12,284,000		$999,733

(in years)

7 Old Dominion University, **TELETECHNET**, July 1993.

Table 9—Estimated Personnel Costs for TELETECHNET at Full Capacity

	Positions	Annual cost
Faculty:		
Full-time	72	$5,459,040
Part-time	12	648,960
Support staff:		
Professional	70	3,500,000
Classified	60	2,055,000
Hourly	20	632,000
Total	234	$12,295,000

The faculty costs shown in Table 9 include funding for course enrollments (studio enrollment plus receive site enrollments) of more than 60 students in the amount of $25 per student. These funds may be used in several ways to offset the additional workload associated with the larger enrollment courses.

Old Dominion also provides other incentives for faculty who participate in the TELETECHNET program. This may include a reduction in teaching load to prepare materials for the first time a faculty member teaches on TELETECHNET, a summer workshop, and, under certain circumstances, a modest stipend. These costs, which are essentially one-time in nature, are not included in the estimates.

Table 10—Estimated Operating Expense for TELETECHNET at Full Capacity

	Annual Cost
Uplink	$2,800,000
Telephone lines	2,540,000
Supplies	800,000
Repair and maintenance	340,000
Software	280,000
Facilities @ CC sites	540,000
Total	$7,300,000

Table 11—Summary of TELETECHNET Costs at Full Capacity

	Total	Cost/course
Faculty costs	$6,108,000	$12,216
Staff costs	6,187,000	12,374
Operating expense	7,300,000	14,600
Annual est. capital cost	999,733	1,999
Grand Total	$20,594,733	$41,189

Cost Comparisons for TELETECHNET at Capacity

The TELETECHNET cost estimates in Table 11 are comprehensive in that they include all costs directly associated with delivery of TELETECHNET courses including estimated annual capital costs and TELETECHNET's overhead. Cost comparisons are made below for two TELETECHNET alternatives: sending a live instructor to several sites to offer the course and (2) offering the course in a regular on-campus setting. Neither alternative is particularly realistic in the sense that no one has proposed sending live instructors to remote sites throughout the commonwealth nor is it likely the target audience of placebound students would, in fact, be able to attend classes on the ODU campus.[8] In regard to the latter comparison, i.e., with on-campus costs, to the extent TELETECHNET estimated costs are even reasonably close to classroom instruction costs, TELETECHNET might be considered a bargain to the state in the sense that moving and relocation costs (no matter who incurs them) are avoided for students who are to attend the on-campus courses. These costs should, of course, be charged against classroom instruction.

Table 12 shows the comparisons. For TELETECHNET courses the cost per FTE depends upon total enrollment in the course which is partly dependent upon the number of sites; for the "send instructor" alternative the costs depend upon the number of sites and course enrollment; for on-campus classroom delivery the costs depend upon total enrollment and average section size (thus determining the number of sections needed for any given level of enrollment).

[8] Two alternatives not explicitly considered here are: (a) migration of TELETECHNET from analog television delivery to a digital computer network that supports full-scale multimedia presentations and (b) the development of course materials at ODU (including syllabi, videotapes, multimedia presentations, etc.) that could be physically or electronically delivered to remote sites asychronously. TELETECHNET is moving toward use of the WWW for delivery of course related materials (syllabi, handout materials, etc.).

Table 12—Comparison of Alternative Delivery Costs per Course and per FTE Based upon Projected TELETECHNET Expenditures at Full Capacity

Course Type	TELETECHNET	Send Instructors	Classroom delivery	
	$41,189/course (*see Note 1*)	$13,296/site (*see Note 2*)	enroll. = 25 $12,341/sec. (*see Note 3*)	enroll. = 50 $12,341/sec.
High demand				
• 12 sites/16.7 ea	$44,689	$159,552	$98,728	$49,364
• 200 students	$2,234/FTE	$7,978/FTE	$4,936/FTE	$2,468/FTE
• 20 FTE				
Med. demand				
• 12 sites/8.3 ea	$42,189	$159,552	$49,364	$24,682
• 100 students	$4,219/FTE	$15,995/FTE	$4,936/FTE	$2,468/FTE
• 10 FTE				
Low demand				
• 10 sites/5 ea	$41,189	$132,960	$24,682	$12,341
• 50 students	$8,238/FTE	$26,592/FTE	$4,936/FTE	$2,468/FTE
• 5 FTE				

Note 1 TELETECHNET course cost based upon projected costs at full capacity operation. Costs of $25 per enrollment over 60 are recognized.

Note 2 Cost per course section per site is $12,216 estimated faculty position cost (this is the same faculty position cost used for TELETECHNET) plus $1,080 travel estimated at 45 round trips at 80 miles each and $.30 per mile for a total of $13,296.

Note 3 Cost per course section is $12,216 faculty staffing cost plus estimated capital cost for the room of $125 for a total of $12,341.

The number of sites for the "send instructor" alternative is based upon the enrollment patterns observed for some of the TELETECHNET courses. Many TELETECHNET courses have enrollments at 15-18 sites, however, so the cost estimates in the table should be understood as lower limits for the "send instructor" alternative.

One striking thing about Table 12 is the cost advantage of on-campus classroom instruction over that of sending many instructors to sites distributed over a wide geographical area. This illustrates the substantial cost advantage of a university campus in the pre-electronic world. The basis for the relative efficiency of the campus arises from bringing a large number of students together in one place where they can be taught by live instructors in relatively large groups (classes). The table also shows the potential for the use of electronic technology to distribute instruction over a large geographic area without sending a live instructor to each site.

For courses that generate enrollments statewide of 200 or more TELETECHNET compares favorably with on-campus costs even if the on-campus courses have relatively large class size. For statewide enrollments of about 100 students, TELETECHNET costs are lower if the on-campus course is taught in relatively small enrollment sections of 25, but more expensive if

the on-campus class enrollments are 50. Finally, for low demand courses with total enrollments in the range of 50, classroom instruction is less expensive even if on-campus section size is relatively small.

None of these results is surprising. The relatively high fixed direct costs of TELETECHNET and its low incremental cost per additional student will always give it a cost advantage for large enrollment courses. This cost structure also means that for low enrollment courses, the classroom alternative is less expensive even if the on-campus classroom alternative may not be a viable option for placebound students across the commonwealth.

Cost Comparisons with TELETECHNET Based on Current Costs

During the 1996-97 academic year TELETECHNET had 17 major programs in place that delivered 101 courses to 17 community college sites plus some military and hospital sites. Approximately 4,600 students are enrolled, generating 1,041 FTE. Total expenditures related to the program were $5,092,303 or $50,418 per course not including capital costs.[9] When capital costs of $1,999[10] from Table 4 are added, the average cost per course is $52,418. Table 6 shows the comparison data (with an adjustment in TELETECHNET course costs as discussed below).

Table 13—Comparison of Alternative Delivery Costs per Course and per FTE Based upon Estimated TELETECHNET Expenditures 1996-97

Course Type	TELETECHNET	Send Instructors	Classroom delivery	
	$52,022/course (*see Note 4*)	$13,296/site (*from Table 5*)	enroll. = 25 $12,341/sec. (*from Table 5*)	enroll. = 50 $12,341/sec. (*from Table 5*)
High demand				
• 12 sites/16.7 ea.	$55,522	$159,552	$98,728	$49,364
• 200 students	$2,776/FTE	$7,978/FTE	$4,936/FTE	$2,468/FTE
• 20 FTE				
Med. demand				
• 12 sites/8.3 ea.	$53,022	$159,552	$49,364	$24,682
• 100 students	$5,302/FTE	$15,995/FTE	$4,936/FTE	$2,468/FTE
• 10 FTE				
Low demand				
• 10 sites/5 ea.	$52,022	$132,960	$24,682	$12,341
• 50 students	$10,404/FTE	$26,592/FTE	$4,936/FTE	$2,468/FTE
• 5 FTE				

Note 4 The per course value used in this table is net of the $25 per student cost recognized for enrollments over 60. The adjustment was made by deducting the total estimated payment (based upon average course enrollments) from total expenditures before calculating the per course cost. The appropriate overage payment is then added back into the course costs for enrollments of 200 and 100.

With TELETECHNET operating at about 23 percent of planned capacity, its per course costs are about 27 percent higher than projected costs at 4,500 FTE. As Table 13 shows, even at these cost levels, TELETECHNET compares favorably with classroom costs for high demand courses if the on-campus version is taught with a class size of 25. At larger class size, the on-campus version is only slightly less expensive. For medium demand courses the on-campus version is only slightly less expensive than TELETECHNET if the course is taught with small section size. For medium demand courses taught with section size of 50 and for low demand courses taught on-campus with class sizes of 25 or 50, the on-campus alternative is substantially less expensive.

Again, the results are not surprising and the pattern is entirely consistent with the results shown in Table 5. At its current level of operation TELETECHNET costs compare favorably with on-campus course costs for high demand courses. Even for medium demand courses, if taught on campus with section size of 25, TELETECHNET costs are only slightly higher.

[9] The cost data are contained in a memo from Anne R. Savage, Associate Vice President to Jo Ann Gora, Provost and Vice President, TELETECHNET Expenditures, March 25, 1997.

[10] Capital costs are imputed based upon the assumption of reasonably full utilization of the capital resource. That assumption is not changed for this particular comparison.